

Industrial Technologies Program

New Sustainable Chemistries for Low-VOC Coatings

New Novel Polymers Offer Significant Reduction in Use of Raw Materials

The North American architectural coatings industry sold over 700 million gallons of paint in 2002 for a value of \$7 billion dollars. Waterborne coatings comprised 83 percent of these shipments. Waterborne coatings use polymer emulsions to bind mineral pigments and adhere the resulting pigment/binder film to the substrate upon drying. In performing these important functions, however, only the outer surface of the particles participates in the binding operation, resulting in significant waste of polymer emulsion materials.

These novel polymer particles offer a paradigm shift in coating technology. It is estimated that only 25 nanometers of the outer layers of an emulsion particle are used in the inter-particle inter-penetration that occurs during emulsion film formation. Novel Polymeric Binders matched with new, non-volatile, biomass-derived coalescing agents will deliver architectural coatings possessing a new level of performance, environmental friendliness, and cost efficiency. These technologies could remove as much as 30 percent of raw material from the polymer particles in emulsions, yielding significant cost savings for the architectural coatings industry.

Benefits

- 30-percent reduction in raw material use for polymer particles in emulsions
- Improved performance, environmental friendliness, and cost efficiency

Applications

These novel polymer particles will initially benefit domestic markets for waterborne architectural coatings but will expand into the paper, industrial coatings, carpets, textiles, and construction industries.

Project Partners

- Rohm and Haas Company
Philadelphia, PA
- Archer Daniels Midland Company
Decatur, Illinois
- University of Minnesota
Minneapolis-St. Paul, Minnesota

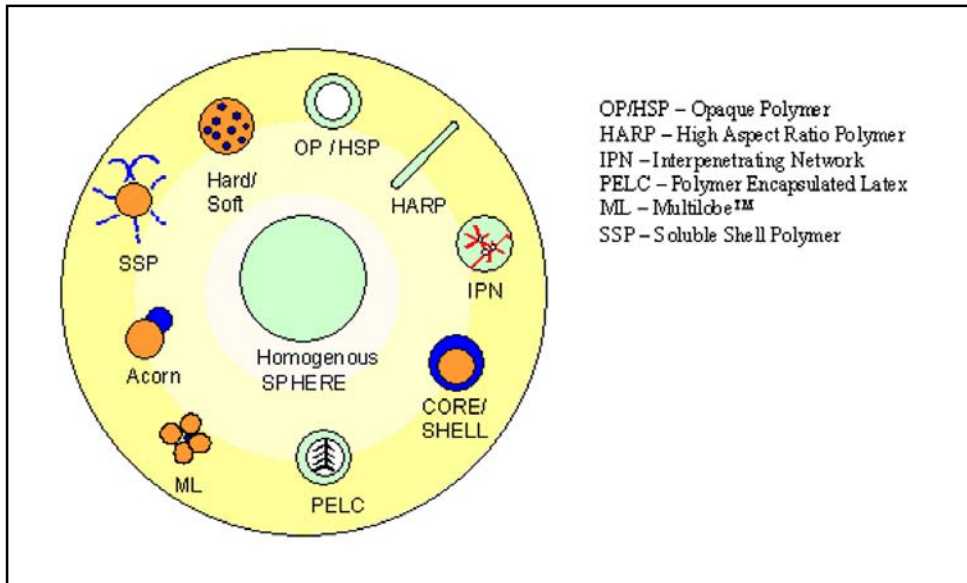


Fig. 1: Morphologies from Rohm and Haas Companies

Industrial Technologies Program

Project Description

Goal: The objective of the project is to develop novel polymer emulsion particles that require 30 percent less raw material.

Technology: Investigators will attempt to create novel polymer particles with air voids that are capable of withstanding the rigors of film formation. Investigators will work to develop emulsion polymer particles, with unique morphology that deliver typical emulsion binder performance - using 30% less raw material than is currently used in emulsion manufacture. The new binders from Rohm and Haas Company will be matched with new, non-volatile, biomass-derived coalescing agents from Archer Daniels Midland Company.

Activities: The project will cover a five-year span and cost a total of approximately \$6.66 million, 30 percent of which will come from the industrial partners. The project will address the following key tasks and milestones:

- *Concept Validation with Acrylics* - Limited scouting experiments have demonstrated that the Novel Binders are feasible. These findings must be confirmed and shown to be repeatable in standard glassware.

- *Vinyl Acrylic and Styrene Acrylic Synthesis* - Investigators will have to develop vinyl and styrene acrylic emulsions as opposed to acrylic-only polymers to achieve cost efficiency.
- *Particle Morphology Optimization* - Investigators will create polymers that look to achieve the highest raw material reductions possible.
- *Synthesis of New Coalescents* - Investigators will look at multiple synthetic approaches towards creating new, low-VOC coalescents.
- *Candidate Evaluations* - Investigators will extensively test one or more prototype combinations of novel polymers and coalescent.
- *Customer Sampling and Optimization Following Customer Feedback* - A representative customer group will evaluate the products. Investigators will use the customer feedback to complete any necessary improvements.
- *Process Optimization and Stress Studies* - Investigators will address processing studies necessary to convert laboratory synthesis procedures to industrial commercial processes.
- *Polymer Characterization* - Continuous studies will provide a record of the project.

For Additional Information, please contact:

Andrew Swartz
Project Leader, Architectural Coatings
Rohm and Haas Company
Phone: (215) 619-5777
E-mail: aswartz@rohmmaas.com

For Program Information, please contact:

Brian Valentine
Industrial Technologies program
U.S. Department of Energy
1000 Independence Ave., SW
Washington, D.C. 20585
Phone: (202) 586-7543
Fax: (202) 586-1658
E-mail: brian.valentine@ee.doe.gov

Please send any comments, questions, or suggestions to webmaster.eren@nrel.gov

Visit our home page at www.eere.energy.gov/industry

**Industrial Technologies Program
Energy Efficiency and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585**



U.S. Department of Energy
Energy Efficiency
and Renewable Energy

February 2004